MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018/2019 SESSION

PPS 0016 – INTRODUCTION TO PROBABILITY AND STATISTICS

(All sections / Groups)

31 MAY 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 4 pages with 5 questions and an appendix.
2. The appendix is the cumulative standard normal distribution table.
3. Answer all questions.
4. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to **four** significant figures.
5. Write your answers in the Answer Booklet provided.
6. Show all relevant steps to obtain maximum marks.

Question 1

(a) The sample data of time intervals (in seconds) between telephone calls received at an office on a particular day after 8.30 a.m. are as follows:

34	25	119	16	12	72	5	41	12	66
118	2	22	40	25	39	19	67	4	13
23	104	35	118	85	67	14	16	50	16
24	10	48	24	76	6	3	61	5	58
56	2	24	44	12	20	8	11	29	82

(i) Use Sturges' formula to find the number of classes if the above data are to be organized in classes. Round up the number of classes to the nearest integer. [2 marks]

(ii) Use the range and the answer in (a)(i) above to find the class size. Round up the answer to the nearest integer. [2 marks]

(iii) Using (a)(i) and (a)(ii), prepare a cumulative frequency distribution table as shown below. Use the smallest value in the data as the lower limit of the first class. [5 marks]

Class Limits	Class Boundaries	Tally	Frequency	Cumulative frequency

⋮

(iv) Draw an ogive for the data using the table built in (a)(iii). [4 marks]

(v) From the ogive, estimate the

(1) median, [1 mark]

(2) time interval that is exceeded by 25% of the data, [1 mark]

(3) time interval where 25% of the data fall below. [1 mark]

(b) The exam marks of all the 8 students in a class are 23, 88, 100, 79, 56, 51, 94, and 41.

(i) Find the mean score. [1½ marks]

(ii) Find the standard deviation of the score. [2½ marks]

Continued...

Question 2

(a) Consider the word 'HIPPOPOTAMUS'.

(i) Calculate the number of ways the letters can be arranged. [2 marks]

(ii) Calculate the number of ways the letters can be arranged if they must start with the letter P. [2 marks]

(iii) Calculate the number of ways the letters can be arranged if they must start with the letters PP. [2 marks]

(b) A class consists of 22 boys and 19 girls. Two boys and two girls are to be selected to form a team for a competition.

(i) How many ways of forming the team are there? [2 marks]

(ii) Ali (a boy) is in the class. What is the probability that Ali will be selected into the team? [2 marks]

(c) 70 students sit for the final examination of a subject. The table below shows how many of them pass or fail the subject as well as their class attendance record throughout the semester.

	Attendance is 80% or higher (H)	Attendance is less than 80% (L)
Pass (P)	x	4
Fail (F)	2	y

(i) Find x and y given that the number of students who fail the subject is one-sixth of the number of students who pass. [5 marks]

(ii) One student is selected at random from these 70 students. Find the probability that this student passes the subject or whose attendance is 80% or higher. [3 marks]

(iii) One student is selected at random from these 70 students. Find the probability that this student has attendance less than 80% given that the student passes the subject. [2 marks]

Question 3

(a) A discrete random variable X has the following probability distribution:

x	-1	0	1	2	3
$P(X=x)$	$\frac{1}{5}$	k	$\frac{1}{10}$	$2k$	$\frac{1}{5}$

where k is a constant. Find

(i) the value of k. [3 marks]

(ii) $\mathrm{E}(X)$. [3 marks]

(iii) $\mathrm{Var}(X)$. [4 marks]

(b) A continuous random variable Y has the probability density function given by

$$f(y)=\begin{cases}1+y, & -1<y<0\\ 1-y, & 0\le y<1\\ 0, & \text{otherwise}\end{cases}$$

(i) Construct the cumulative distribution function (cdf), $F(y)$. Express the cdf as a piecewise function. [6 marks]

(ii) Find $P(-0.5<Y<0.75)$. [4 marks]

Continued...

Question 4

(a) A trick coin has a 65% probability of landing heads up. If the coin is tossed 4 times,

(i) determine the mean and standard deviation of the number of heads. [4 marks]

(ii) find the probability that **less than** 2 heads are obtained. [4 marks]

(b) The mean number of defective products produced by a factory line in a given day is 2. Find the probability that, in any two consecutive days, **not more than** 3 defective products are produced (using the appropriate probability formula). [6 marks]

(c) The CGPAs of students in a class follow a normal distribution with mean 2.81 and standard deviation 0.85. It is known that 40% of students fail to obtain a certain minimum CGPA, m. Find m, rounded to two decimal places. [6 marks]

Question 5

(a) Let X be the weight (in grams) of a chocolate bar with mean weight 54.5 grams and standard deviation 2.2 grams. Let $\overline{X}$ be the sample mean of a random sample of size 30.

(i) What type of distribution does the sampling distribution of the sample mean $\overline{X}$ have? Explain why. [2 marks]

(ii) Find the mean and standard deviation of the sampling distribution of the sample mean $\overline{X}$. [2 marks]

(iii) Find $P(54.1 < \overline{X} < 54.8)$. [6 marks]

(b) From past experience, 10% of a large shipment of automobile parts is defective. A random sample of 900 parts is selected.

(i) Show that the sampling distribution of the sample proportion can be approximated using the normal distribution. [4 marks]

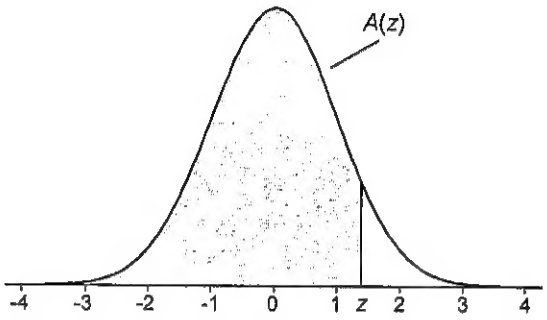
(ii) What is the probability that less than 9% of the shipment of automobile parts is defective? [6 marks]

Continued...

Appendix

TABLE A.1

Cumulative Standardized Normal Distribution



$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

End of Page